

1. In a database management system that includes a database engine that
2 accesses and updates objects in a database, the database engine receiving high-level
3 document commands, each high-level document command for performing an operation on
4 a document that is associated with a plurality of tables in the database, a method for
5 reliably notifying client applications of the implementation of particular high-level
6 document commands in the database, the notification surviving even system failures, the
7 method comprising the following:

8 an act of implementing a high-level document command in the database;

9 an act of altering a persistently stored notification table to reflect the
10 implementation of the high-level document command in the database;

11 an act of identifying one or more client applications that are to be notified
12 of the implementation of the high-level document command;

13 an act of dispatching a notification of the implementation to the one or more
14 identified client applications;

15 an act of receiving acknowledgement from the one or more client
16 applications that the notification has been received; and

17 in response to receiving acknowledgement, an act of altering the
18 notification table to reflect that the client application no longer needs to be notified
19 of the implementation of the high-level document command in the database.

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21 2. The method in accordance with Claim 1, wherein the notification table is
22 stored in the database.
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1 3. The method in accordance with Claim 1, wherein the act of dispatching a
2 notification of the implementation to the one or more identified client applications
3 comprises an act of transmitting a message to a machine that hosts the client application,
4 the machine that host the client application being different than the machine that hosts the
5 database management system.

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7 4. The method in accordance with Claim 1, wherein the act of dispatching a
8 notification of the implementation to the one or more identified client applications
9 comprises an act of passing the notification through a function call to the identified client
10 application, the client application hosted by the same machine as at least the portion of the
11 database management system responsible for performing the act of dispatching the
12 notification.

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14 5. The method in accordance with Claim 1, wherein the act of implementing a
15 high-level document command in the database and the act of altering a persistently stored
16 notification table to reflect the implementation of the high-level document command in the
17 database are atomically performed, the acts of implementing and altering either both
18 occurring or both not occurring at all.

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20 6. The method in accordance with Claim 1, wherein the act of implementing a
21 high-level document command in the database and the act of altering a persistently stored
22 notification table to reflect the implementation occur in the same transaction of a database
23 engine.

1 7. The method in accordance with Claim 1, wherein the document comprises
2 an electronic mail message.

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4 8. The method in accordance with Claim 1, wherein the document comprises a
5 folder.

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7 9. The method in accordance with Claim 1, wherein the act of implementing
8 the high-level document command in the database comprises an act of moving the
9 document.

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11 10. The method in accordance with Claim 1, wherein the act of implementing
12 the high-level document command in the database comprises an act of deleting the
13 document.

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15 11. The method in accordance with Claim 1, wherein the act of implementing
16 the high-level document command in the database comprises an act of copying the
17 document.

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19 12. The method in accordance with Claim 1, wherein the act of implementing
20 the high-level document command in the database comprises an act of adding the
21 document.

1 13. The method in accordance with Claim 1, wherein the act of implementing
2 the high-level document command in the database comprises an act of updating the
3 document.

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5 14. The method in accordance with Claim 1, wherein the received
6 acknowledgement indicates that the client application has received the notification.

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8 15. The method in accordance with Claim 1, wherein the received
9 acknowledgement indicates that the client application has implemented processes in
10 response to the notification.

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1 16. In a database management system that includes a database engine that
2 accesses and updates objects in a database, the database engine receiving high-level
3 document commands, each high-level document command for performing an operation on
4 a document that is associated with a plurality of tables in the database, a method for
5 reliably notifying client applications of the implementation of particular high-level
6 document commands in the database, the notification surviving even system failures, the
7 method comprising the following:

8 an act of implementing a high-level document command in the database;
9 and

10 a step for ensuring a corresponding notification about the high-level
11 document command is preserved until all of the client applications to be notified
12 acknowledge at least receipt of the notification.

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14 17. The method in accordance with Claim 16, wherein the step for ensuring a
15 corresponding notification about the high-level document command is preserved comprises
16 the following:

17 an act of altering a persistently stored notification table to reflect the
18 implementation of the high-level document command in the database;

19 an act of identifying one or more client applications that are to be notified
20 of the implementation of the high-level document command;

21 an act of dispatching a notification of the implementation to the one or more
22 identified client applications;

23 an act of receiving acknowledgement from the one or more client
24 applications that the notification has been received; and

1 in response to receiving acknowledgement, an act of altering the
2 notification table to reflect that the client application no longer needs to be notified
3 of the implementation of the high-level document command in the database.

5 18. The method in accordance with Claim 16, wherein the notification table is
6 stored in the database.

1 19. A computer program product for use in a database management system that
2 includes a database engine that accesses and updates objects in a database, the database
3 engine receiving high-level document commands, each high-level document command for
4 performing an operation on a document that is associated with a plurality of tables in the
5 database, the computer-program product for implementing a method for reliably notifying
6 client applications of the implementation of particular high-level document commands in
7 the database, the notification surviving even system failures, the computer program
8 product including a computer-readable medium having stored thereon computer-executable
9 instructions for performing the following:

10 an act of causing a high-level document command to be implemented in the
11 database;

12 an act of causing a persistently stored notification table to be altered to
13 reflect the implementation of the high-level document command in the database;

14 an act of identifying one or more client applications that are to be notified
15 of the implementation of the high-level document command;

16 an act of causing a notification of the implementation to be dispatched to
17 the one or more identified client applications;

18 an act of detecting receipt of acknowledgement from the one or more client
19 applications that the notification has been received; and

20 in response to receiving acknowledgement, an act of causing the
21 notification table to be altered reflect that the client application no longer needs to
22 be notified of the implementation of the high-level document command in the
23 database.

1 20. The computer program product in accordance with Claim 19, wherein the
2 computer-executable instructions for performing the act of causing a notification of the
3 implementation to be dispatched to the one or more identified client applications comprise
4 computer-executable instruction for performing an act of causing a message to be
5 transmitted to a machine that hosts the client application, the machine that hosts the client
6 application being different than the machine that hosts the database management system.

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8 21. The computer program product in accordance with Claim 19, wherein the
9 computer-executable instructions for performing the act of causing a notification of the
10 implementation to be dispatched to the one or more identified client applications comprises
11 computer-executable instructions for performing an act of causing the notification to be
12 passed through a function call to the identified client application, the client application
13 hosted by the same machine as at least the portion of the database management system
14 responsible for performing the act of dispatching the notification.

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16 22. The computer program product in accordance with Claim 19, wherein the
17 computer-executable instructions for performing the act of implementing a high-level
18 document command in the database and the computer-executable instructions for
19 performing the act of altering a persistently stored notification table to reflect the
20 implementation of the high-level document command in the database are configured to
21 atomically performing the acts of implementing and the act of altering.

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23 23. The computer program product in accordance with Claim 19, wherein the
24 document comprises an electronic mail message.

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2 24. The computer program product in accordance with Claim 19, wherein the
3 document comprises a folder.

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5 25. The computer program product in accordance with Claim 19, wherein the
6 computer-executable instructions for performing the act of causing the high-level
7 document command to be implemented in the database comprises comprise computer-
8 executable instructions for performing an act of moving the document.

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10 26. The computer program product in accordance with Claim 19, wherein the
11 computer-executable instructions for performing the act of causing the high-level
12 document command to be implemented in the database comprises comprise computer-
13 executable instructions for performing an act of deleting the document.

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15 27. The computer program product in accordance with Claim 19, wherein the
16 computer-executable instructions for performing the act of causing the high-level
17 document command to be implemented in the database comprises comprise computer-
18 executable instructions for performing an act of copying the document.

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20 28. The computer program product in accordance with Claim 19, wherein the
21 computer-executable instructions for performing the act of causing the high-level
22 document command to be implemented in the database comprises comprise computer-
23 executable instructions for performing an act of adding the document.

1 29. The computer program product in accordance with Claim 19, wherein the
2 computer-executable instructions for performing the act of causing the high-level
3 document command to be implemented in the database comprise computer-executable
4 instructions for performing an act of updating the document.

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1 30. In a database management system that includes a database engine that
2 accesses and updates tables in a database, the database engine receiving high-level
3 document commands, each high-level document command for performing an operation on
4 a document that is associated with a plurality of tables in the database, a method for
5 recovering from a database management system failure while allowing notifications that
6 were to be sent but for the failure to be sent to one or more client applications upon
7 restarting the database management system, the method comprising the following:

8 an act of examining a notification table upon restarting the database
9 management system, the notification table identifying implemented high-level
10 document commands for which one or more client applications should be notified;

11 based on the examination of the notification table, an act of identifying a
12 notification that should have been sent to the one or more client applications, but
13 for which acknowledgement has not been received from the one or more client
14 applications; and

15 an act of dispatching the notification of the implementation to the one or
16 more identified client applications.

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18 31. The method in accordance with Claim 30, further comprising the following:

19 an act of receiving acknowledgement from the one or more client
20 applications that the notification has been received; and

21 in response to receiving acknowledgement, an act of altering the
22 notification table to reflect that the client application no longer needs to be notified
23 of the implementation of the high-level document command in the database.